## CMPT 429.3/833.3

### CLOSED BOOK

TIME: 50 Minutes           MIDTERM EXAM          November 18/91

MARKS:

10       1. From a programming language design viewpoint, give a brief evaluation of high-level programming language that you know well.

10       2. Obtain a grammar for the language which consists of the set of all strings containing more 0's than 1's.

10       3. Construct a nondeterministic finite-state automaton that recognizes the language generated by the regular grammar:

$$G = (\{S, A, B\}, \{0, 1\}, S, \Phi)$$

where $\Phi$ consists of the rules

$$S \rightarrow 1B \mid 0$$

$$A \rightarrow 1A \mid 0B \mid 1 \mid 0$$

$$B \rightarrow 1$$

4. Given the following ambiguous grammar

```
E -> - E
   | * E
   | E * E
   | E / E
   | E = E
   | E + E
   | E - E
   | (E)
```

with operator precedence and associativity according to the following table (higher lines in the table are higher precedence operators).

| Associativity | Operator | Description |
|---|---|---|
| left to right | ( ) | parentheses for grouping (highest precedence) |
| left to right | - * | unary minus and pointer dereference |
| left to right | * / | multiplication, division |
| left to right | + - | addition, subtraction |
| right to left | = | assignment (lowest precedence) |

10       (a) Modify the grammar so that it is not ambiguous.

10       (b) Obtain an LL(1) grammar for your grammar in part (a) which satisfies the table above (show that it is LL(1) !).

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